

CLAIMS

1. A method of making a high-cleanliness steel excellent in cold workability and fatigue characteristic, said method comprising the step of adding a Li-Si alloy and/or Li_2CO_3 having a Li content between 20 and 40% by mass to a molten steel.

2. The method of making a high-cleanliness steel according to claim 1 characterized by adding a substance containing at least one of Ca, Mg, Na and K to the molten steel in addition to the Li-containing substance.

3. The method of making a high cleanliness steel according to claim 1 or 2 characterized by adding the Li-containing substance to the molten steel after the completion of a series of steps of a ladle refining process including composition adjustment, temperature adjustment and slag refining to control the composition of the molten steel such that the molten steel has a total-Li content between 0.020 and 20 ppm by mass and contains 1.0 or below oxide inclusion particle having a major diameter of 20 μm or above in 50 g of the steel wire.

4. The method of making a high-cleanliness steel according to claim 1 or 2 characterized by adding the Li-containing substance at a final stage of a series of steps of a ladle refining process including composition adjustment, temperature adjustment and slag refining such that an oxide inclusion contained in the steel has a CaO content between 15 and 55% by mass, SiO_2

content between 20 and 70% by mass, an Al_2O_3 content of 35% by mass or below, a MgO content of 20% by mass or below and a Li_2O content between 0.5 and 20% by mass.

5. The method of making a high-cleanliness steel according to any one of claims 1 to 4 characterized by adding the Li-containing substance to the molten steel contained in at least one of a ladle, a tundish for continuous casting and a mold for continuous casting.

6. The method of making a high-cleanliness steel according to any one of claims 1 to 5 characterized by adding the Li-containing substance to the molten steel by stirring the molten steel with iron tubular wires containing the Li-containing substance

7. The method of making a high-cleanliness steel according to any one of claims 1 to 5 characterized by adding the Li-containing substance to the molten steel by blowing an inert gas carrying the Li-containing substance into the molten steel.

8. A high-cleanliness steel having a total-Li content between 0.020 and 20 ppm by mass and containing 1.0 or below oxide inclusion particle having a major diameter of 20 μm or above in 50 g of the steel wire.

9. The high-cleanliness steel according to claim 8

wherein the total-Li/Si mass ratio representing the ratio in mass of the total amount of Li contained in the steel to the amount of Si contained in the steel is between 1×10^{-6} and 1000×10^{-6} .

10. A high-cleanliness steel having high fatigue strength and high cold workability containing an oxide inclusion having a CaO content between 15 and 55% by mass, SiO₂ content between 20 and 70% by mass, an Al₂O₃ content of 35% by mass or below, a MgO content of 20% by mass or below and a Li₂O content between 0.5 and 20% by mass.

11. The high-cleanliness steel according to claim 10, wherein the oxide inclusion has a Li₂O/SiO₂ mass ratio between 0.01 and 0.5.

12. The high-cleanliness steel according to claim 10 or 11, wherein the oxide inclusion has a SiO₂ content of 30% by mass or above and below 45% by mass.

13. The high-cleanliness steel according to any one of claims 10 to 12, wherein the oxide inclusion contains Na₂O and/or K₂O and the sum of Li₂O content, Na₂O content and K₂O content is between 0.5 and 20% by mass.

14. The high-cleanliness steel according to any one of claims 8 to 13, wherein the steel has a C content of 1.2% by mass or below, a Si content between 0.1 and 4% by mass, a Mn

content between 0.1 and 2.0% by mass, and an Al content of 0.01% by mass or below.

15. The high-cleanliness steel according to claim 14, wherein the steel has an O content of 0.005% by mass or below, a total-Mg content between 0.1 and 15 ppm by mass and a total-Ca content between 0.1 and 40 ppm by mass.

16. The high-cleanliness steel according to claim 14 or 15, wherein the steel contains at least one of Cr, Ni, V, Nb, Mo, W, Cu and Ti.

17. The high-cleanliness steel according to any one of claims 14 to 16, wherein the other elements of the steel are Fe and unavoidable impurities.